Universidad Nacional Autónoma de México

Facultad de Ingeniería

Fundamentos de Estadística

Tarea 5

Cálculo de Probabilidades

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Grupo: 3

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Índice

1. Desarrollo

Calcular las siguientes probabilidades en tabla (imprimir pantalla y poner en el desarrollo la propiedad de simetría o de complemento cuando la hayan usado), en la aplicación Probability Distributions o página de Matt Bognar (imprimir pantalla) y con R (imprimir pantalla).

1.1. Distribución normal estándar

1.1.1. $P(Z < 1.5) =$

Procedimiento
$P(Z < 1.5) = \Phi(Z) = 0.9332$
Usando tablas

1.50	0.0668	0.9332	0.8664
1.51	0.0655	0.9345	0.8690
1.52	0.0643	0.9357	0.8715
1.53	0.0630	0.9370	0.8740
1.54	0.0618	0.9382	0.8764
1.55	0.0606	0.9394	0.8789
1.56	0.0594	0.9406	0.8812
1.57	0.0582	0.9418	0.8836
1.58	0.0571	0.9429	0.8859
1.59	0.0559	0.9441	0.8882

Figura 1: Probabilidad usando tablas

Usando Probability Distributions

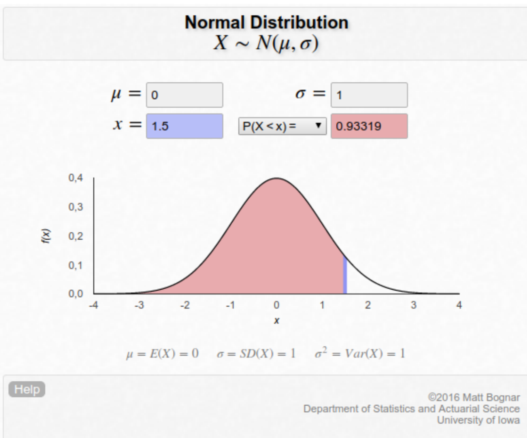


Figura 2: Probabilidad usando la aplicación

Usando R

```
> # Para distribuciones normales
> # 1)
> pnorm(1.5,0,1)
[1] 0.9331928
```

Figura 3: Probabilidad usando R

1.1.2. $P(Z < -3.59) =$

Procedimiento

$P(Z < -3.59) = \Phi(-Z) = 0.0002$

Usando tablas

3.53	0.0002	0.9998	0.9996
3.54	0.0002	0.9998	0.9996
3.55	0.0002	0.9998	0.9996
3.56	0.0002	0.9998	0.9996
3.57	0.0002	0.9998	0.9996
3.58	0.0002	0.9998	0.9997
3.59	0.0002	0.9998	0.9997

Figura 4: Probabilidad usando tablas

Usando Probability Distributions

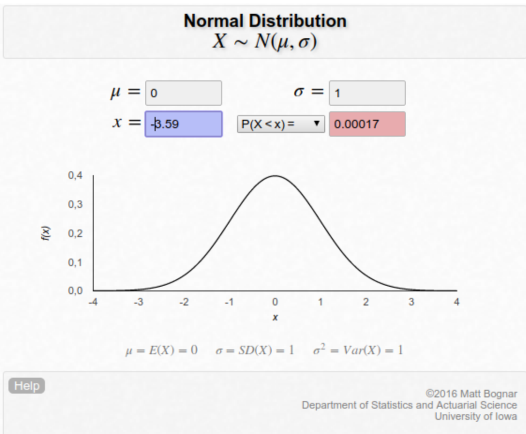


Figura 5: Probabilidad usando la aplicación

Usando R

```
> #2)
> pnorm(-3.59,0,1)
[1] 0.000165339
```

Figura 6: Probabilidad usando R

1.1.3. $P(Z > -0.5) =$

Procedimiento

Por propiedad de simetria tenemos que
$P(Z > -0.5) = P(Z < 0.5) = \Phi(Z) = 0.6915$

Usando tablas

0.50	0.3085	0.6915	0.3829
0.51	0.3050	0.6950	0.3899
0.52	0.3015	0.6985	0.3969
0.53	0.2981	0.7019	0.4039
0.54	0.2946	0.7054	0.4108
0.55	0.2912	0.7088	0.4177
0.56	0.2877	0.7123	0.4245
0.57	0.2843	0.7157	0.4313
0.58	0.2810	0.7190	0.4381
0.59	0.2776	0.7224	0.4448

Figura 7: Probabilidad usando tablas

Usando Probability Distributions

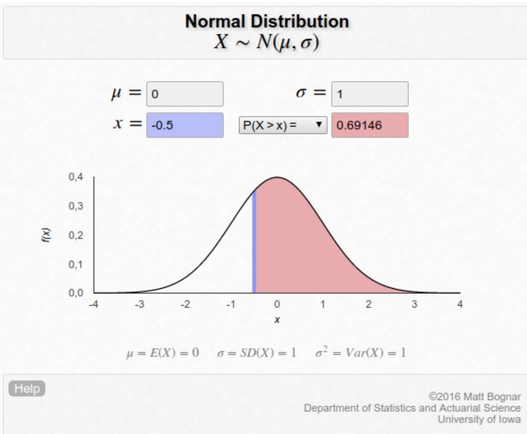


Figura 8: Probabilidad usando la aplicación

Usando R

```
> #3)
> pnorm(0.5,0,1)
[1] 0.6914625
```

Figura 9: Probabilidad usando R

1.1.4. $P(Z > Z_0) = 0.25$

Procedimiento

Por propiedad de simetria tenemos que

$P(Z > Z_0) = 0.25 = P(Z < -Z_0) = \Phi(-Z)$

Usando tablas

0.60	0.2743	0.7257	0.4515	**1.00**
0.61	0.2709	0.7291	0.4581	**1.01**
0.62	0.2676	0.7324	0.4647	**1.02**
0.63	0.2643	0.7357	0.4713	**1.03**
0.64	0.2611	0.7389	0.4778	**1.04**
0.65	0.2578	0.7422	0.4843	**1.05**
0.66	0.2546	0.7454	0.4907	**1.06**
0.67	0.2514	0.7486	0.4971	**1.07**
0.68	0.2483	0.7517	0.5035	**1.08**
0.69	0.2451	0.7549	0.5098	**1.09**

Figura 10: Probabilidad usando tablas

Usando Probability Distributions

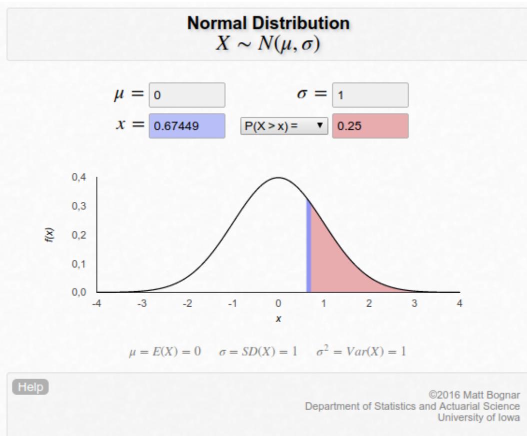


Figura 11: Probabilidad usando la aplicación

Usando R

```
> #4)
> qnorm(0.25,0,1)
[1] -0.6744898
```

Figura 12: Probabilidad usando R

1.1.5. $P(-2.5 < Z < -0.3) =$

Procedimiento

$P(-2.5 < Z < -0.3) = P(Z < -0.3) - P(Z < -2.5) = \Phi(-0.3) - \Phi(-2.5) = 0.3759$

Usando tablas

0.30	0.3821	0.6179	0.2358	**0.70**
0.31	0.3783	0.6217	0.2434	**0.71**
0.32	0.3745	0.6255	0.2510	**0.72**
0.33	0.3707	0.6293	0.2586	**0.73**
0.34	0.3669	0.6331	0.2661	**0.74**
0.35	0.3632	0.6368	0.2737	**0.75**
0.36	0.3594	0.6406	0.2812	**0.76**
0.37	0.3557	0.6443	0.2886	**0.77**
0.38	0.3520	0.6480	0.2961	**0.78**
0.39	0.3483	0.6517	0.3035	**0.79**

Figura 13: Probabilidad 1 usando tablas

2.50	0.0062	0.9938	0.9876
2.51	0.0060	0.9940	0.9879
2.52	0.0059	0.9941	0.9883
2.53	0.0057	0.9943	0.9886
2.54	0.0055	0.9945	0.9889
2.55	0.0054	0.9946	0.9892
2.56	0.0052	0.9948	0.9895
2.57	0.0051	0.9949	0.9898
2.58	0.0049	0.9951	0.9901
2.59	0.0048	0.9952	0.9904

Figura 14: Probabilidad 2 usando tablas

Usando Probability Distributions

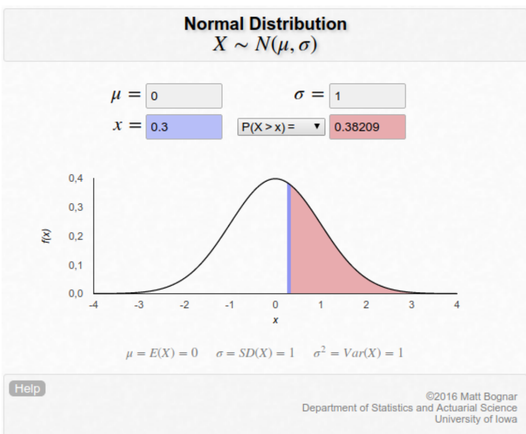


Figura 15: Probabilidad 1 usando la aplicación

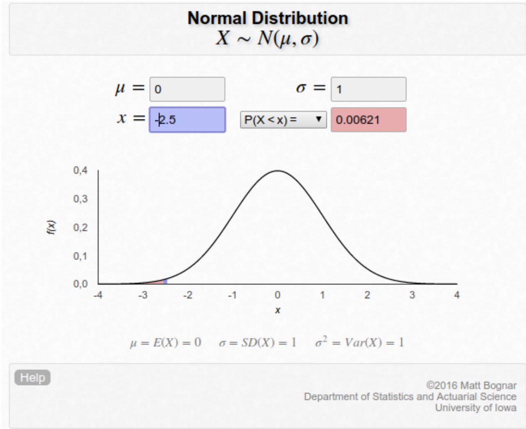


Figura 16: Probabilidad 2 usando la aplicación

Usando R

```
> #5
> pnorm(c(-0.3), mean = 0, sd = 1) - pnorm(c(-2.5), mean = 0, sd = 1)
[1] 0.3758789
```

Figura 17: Probabilidad usando R

1.2. Teorema central del límite

1.2.1. Problema 6

La duración de la enfermedad de Alzheimer desde el principio de los síntomas hasta el fallecimiento del paciente varía de 3 a 20 años; el promedio es 8 años con una desviación estándar de 4 años. El administrador de un gran centro médico selecciona al azar 30 registros de pacientes de Alzheimer ya fallecidos y anota la duración promedio. Encuentre la probabilidad de que la duración promedio de esa muestra esté entre 7 y 9 años.

Solución

$$P(7 < \overline{X} < 9) = P\left(\frac{7-8}{\frac{4}{\sqrt{30}}} < Z < \frac{9-8}{\frac{4}{\sqrt{30}}}\right)$$

$$P(7 < \overline{X} < 9) = P(-1.3693 < Z < 1.3693)$$

$$P(7 < \overline{X} < 9) = D(Z) = 0.8262$$

Usando tablas

1.30	0.0968	0.9032	0.8064
1.31	0.0951	0.9049	0.8098
1.32	0.0934	0.9066	0.8132
1.33	0.0918	0.9082	0.8165
1.34	0.0901	0.9099	0.8198
1.35	0.0885	0.9115	0.8230
1.36	0.0869	0.9131	0.8262
1.37	0.0853	0.9147	0.8293
1.38	0.0838	0.9162	0.8324
1.39	0.0823	0.9177	0.8355

Figura 18: Probabilidad usando tablas

Usando Probability Distributions

Para este caso debemos obtener el complemento, es decir:
$P(7 < \overline{X} < 9) = 1 - 0.1709 = 0.8262$

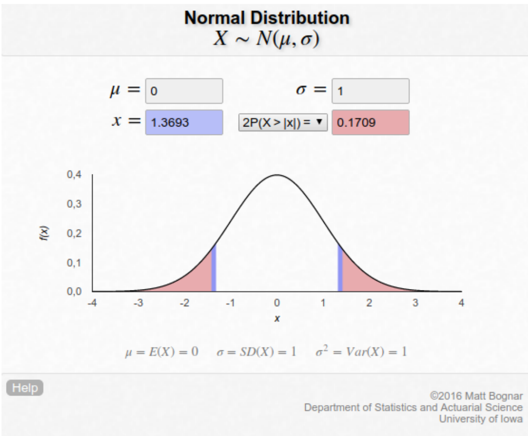


Figura 19: Probabilidad usando la aplicación

Usando R

```
> #6
> pnorm(c(1.3693), mean = 0, sd = 1) - pnorm(c(-1.3693), mean = 0, sd = 1)
[1] 0.8290945
```

Figura 20: Probabilidad usando R

1.2.2. Problema 7

Una empresa metalúrgica produce rodamientos con un diámetro que tiene una distribución normal, con media 3.0005 pulgadas y desviación estándar de 0.0010 pulgadas. Las especificaciones requieren que los diámetros estén en el intervalo 3.000 ± 0.0020 pulgadas. Los cojinetes cuyos diámetros quedan fuera de ese intervalo se rechazan. ¿Qué fracción de la producción total no será rechazada?

Solución

$$P(\frac{2.998 - 3.000}{0.0010} < \frac{\overline{X} - \mu}{\sigma} < \frac{3.0020 - 3.000}{0.0010})$$

$P(-2 < Z < 2) = D(2) = 0.0025$

Usando tablas

%	$z(\Phi)$	$z(D)$	%
0.0	$-\infty$	0	**5.0**
0.1	-3.090	0.001	**5.1**
0.2	-2.878	0.003	**5.2**
0.3	-2.748	0.004	**5.3**
0.4	-2.652	0.005	**5.4**
0.5	-2.576	0.006	**5.5**
0.6	-2.512	0.008	**5.6**
0.7	-2.457	0.009	**5.7**
0.8	-2.409	0.010	**5.8**
0.9	-2.366	0.011	**5.9**
1.0	-2.326	0.013	**6.0**
1.1	-2.290	0.014	**6.1**
1.2	-2.257	0.015	**6.2**
1.3	-2.226	0.016	**6.3**
1.4	-2.197	0.018	**6.4**
1.5	-2.170	0.019	**6.5**
1.6	-2.144	0.020	**6.6**
1.7	-2.120	0.021	**6.7**
1.8	-2.097	0.023	**6.8**
1.9	-2.075	0.024	**6.9**
2.0	-2.054	0.025	**7.0**

Figura 21: Probabilidad usando tablas

1.3. Distribución Ji-cuadrada

1.3.1. $P(X_{16} < k) = 0.95$

$k = 26.2962$

Procedimiento

$P(X_{16} < k) = 0.95 = 1 - P(X_{16} > k)$

$\rightarrow P(X_{16} > k) = 0.05$

Usando tablas

Gl=ν	Valores de la distribución Ji-Cuadrada para una probabilidad α de á						
	0.035	0.965	0.040	0.960	0.045	0.955	0.050
1	4.4452	0.0019	4.2179	0.0025	4.0186	0.0032	3.8415
2	6.7048	0.0713	6.4377	0.0816	6.2022	0.0921	5.9915
3	8.6069	0.2731	8.3112	0.3002	8.0495	0.3263	7.8147
4	10.3450	0.5824	10.0255	0.6271	9.7423	0.6698	9.4877
5	11.9846	0.9693	11.6443	1.0313	11.3423	1.0898	11.0705
6	13.5567	1.4140	13.1978	1.4924	12.8789	1.5659	12.5916
7	15.0790	1.9033	14.7030	1.9971	14.3686	2.0848	14.0671
8	16.5626	2.4281	16.1708	2.5367	15.8220	2.6377	15.5073
9	18.0150	2.9821	17.6083	3.1047	17.2460	3.2185	16.9190
10	19.4415	3.5606	19.0208	3.6965	18.6457	3.8225	18.3070
11	20.8462	4.1600	20.4120	4.3087	20.0249	4.4463	19.6752
12	22.2321	4.7775	21.7851	4.9385	21.3864	5.0873	21.0261
13	23.6015	5.4109	23.1423	5.5838	22.7326	5.7432	22.3620
14	24.9564	6.0583	24.4854	6.2426	24.0651	6.4125	23.6848
15	26.2985	6.7183	25.8161	6.9137	25.3855	7.0936	24.9958
16	27.6289	7.3896	27.1356	7.5958	26.6950	7.7854	26.2962
17	28.9489	8.0712	28.4449	8.2878	27.9947	8.4868	27.5871
18	30.2594	8.7622	29.7450	8.9889	29.2855	9.1971	28.8693
19	31.5610	9.4617	31.0367	9.6983	30.5680	9.9155	30.1435
20	32.8547	10.1691	32.3206	10.4154	31.8430	10.6413	31.4104

Figura 22: Probabilidad usando tablas

Usando Probability Distributions

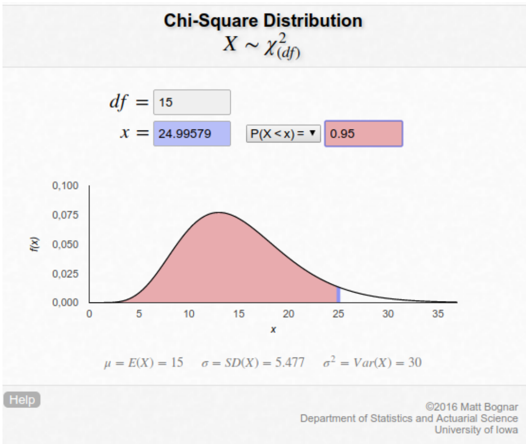


Figura 23: Probabilidad usando la aplicación

Usando R

1.3.2. $P(X_{25} > k) = 0.005$

$k = 46.9280$

Usando tablas

Gl=ν	Valores de la distribución Ji-Cuadrad			
	0.005	**0.995**	**0.010**	**0.990**
1	7.8794	0.0000	6.6349	0.0002
2	10.5965	0.0100	9.2104	0.0201
3	12.8381	0.0717	11.3449	0.1148
4	14.8602	0.2070	13.2767	0.2971
5	16.7496	0.4118	15.0863	0.5543
6	18.5475	0.6757	16.8119	0.8721
7	20.2777	0.9893	18.4753	1.2390
8	21.9549	1.3444	20.0902	1.6465
9	23.5893	1.7349	21.6660	2.0879
10	25.1881	2.1558	23.2093	2.5582
11	26.7569	2.6032	24.7250	3.0535
12	28.2997	3.0738	26.2170	3.5706
13	29.8193	3.5650	27.6882	4.1069
14	31.3194	4.0747	29.1412	4.6604
15	32.8015	4.6009	30.5780	5.2294
16	34.2671	5.1422	31.9999	5.8122
17	35.7184	5.6973	33.4087	6.4077
18	37.1564	6.2648	34.8052	7.0149
19	38.5821	6.8439	36.1908	7.6327
20	39.9969	7.4338	37.5663	8.2604
21	41.4009	8.0336	38.9322	8.8972
22	42.7957	8.6427	40.2894	9.5425
23	44.1814	9.2604	41.6383	10.1957
24	45.5584	9.8862	42.9798	10.8563
25	46.9280	10.5196	44.3140	11.5240
26	48.2898	11.1602	45.6416	12.1982

Figura 24: Probabilidad usando tablas

Usando Probability Distributions

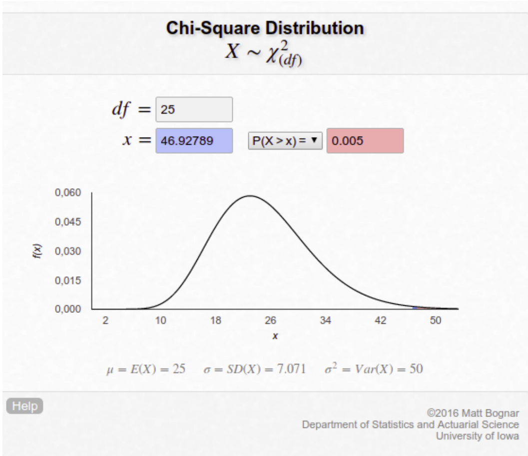


Figura 25: Probabilidad usando la aplicación

Usando R

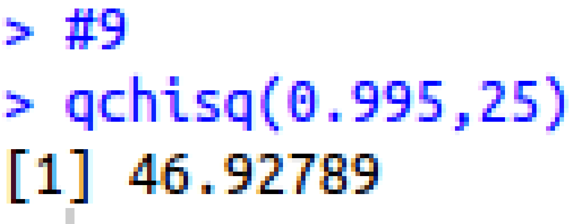


Figura 26: Probabilidad usando R

1.3.3. $P(X_{29} > 47.9147) =$

$P(X_{29} > 47.9147) = 0.015$
Usando tablas

Gl=ν	Valores de la distribución Ji-Cuadrada para una probabilic					
	0.005	**0.995**	**0.010**	**0.990**	**0.015**	**0.985**
1	7.8794	0.0000	6.6349	0.0002	5.9165	0.0004
2	10.5965	0.0100	9.2104	0.0201	8.3994	0.0302
3	12.8381	0.0717	11.3449	0.1148	10.4651	0.1516
4	14.8602	0.2070	13.2767	0.2971	12.3391	0.3682
5	16.7496	0.4118	15.0863	0.5543	14.0978	0.6618
6	18.5475	0.6757	16.8119	0.8721	15.7774	1.0160
7	20.2777	0.9893	18.4753	1.2390	17.3984	1.4184
8	21.9549	1.3444	20.0902	1.6465	18.9738	1.8603
9	23.5893	1.7349	21.6660	2.0879	20.5125	2.3348
10	25.1881	2.1558	23.2093	2.5582	22.0206	2.8372
11	26.7569	2.6032	24.7250	3.0535	23.5028	3.3634
12	28.2997	3.0738	26.2170	3.5706	24.9628	3.9103
13	29.8193	3.5650	27.6882	4.1069	26.4034	4.4757
14	31.3194	4.0747	29.1412	4.6604	27.8268	5.0573
15	32.8015	4.6009	30.5780	5.2294	29.2349	5.6534
16	34.2671	5.1422	31.9999	5.8122	30.6292	6.2628
17	35.7184	5.6973	33.4087	6.4077	32.0111	6.8842
18	37.1564	6.2648	34.8052	7.0149	33.3817	7.5165
19	38.5821	6.8439	36.1908	7.6327	34.7419	8.1589
20	39.9969	7.4338	37.5663	8.2604	36.0926	8.8105
21	41.4009	8.0336	38.9322	8.8972	37.4345	9.4708
22	42.7957	8.6427	40.2894	9.5425	38.7681	10.1390
23	44.1814	9.2604	41.6383	10.1957	40.0941	10.8147
24	45.5584	9.8862	42.9798	10.8563	41.4129	11.4974
25	46.9280	10.5196	44.3140	11.5240	42.7252	12.1867
26	48.2898	11.1602	45.6416	12.1982	44.0312	12.8821
27	49.6450	11.8077	46.9628	12.8785	45.3311	13.5833
28	50.9936	12.4613	48.2782	13.5647	46.6255	14.2900
29	52.3355	13.1211	49.5878	14.2564	47.9147	15.0019
30	53.6719	13.7867	50.8922	14.9535	49.1988	15.7188

Figura 27: Probabilidad usando tablas

Usando Probability Distributions

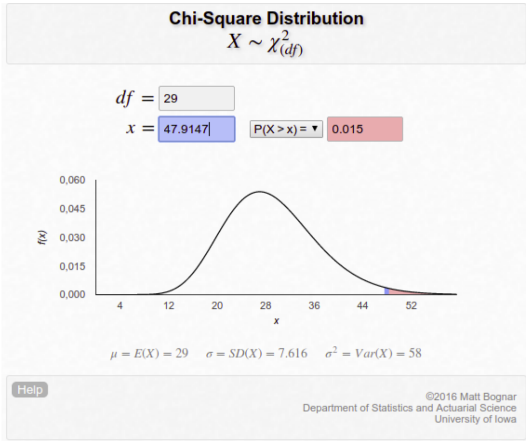


Figura 28: Probabilidad usando la aplicación

Usando R

```
> #10
> pchisq(47.9147,29, lower.tail = F)
[1] 0.01500005
```

Figura 29: Probabilidad usando R

1.3.4. $P(X_{21} > 8.0336) =$

$P(X_{21} > 8.0336) = 0.995$
Usando tablas

Gl=ν	Valores de la di	
	0.005	0.995
1	7.8794	0.0000
2	10.5965	0.0100
3	12.8381	0.0717
4	14.8602	0.2070
5	16.7496	0.4118
6	18.5475	0.6757
7	20.2777	0.9893
8	21.9549	1.3444
9	23.5893	1.7349
10	25.1881	2.1558
11	26.7569	2.6032
12	28.2997	3.0738
13	29.8193	3.5650
14	31.3194	4.0747
15	32.8015	4.6009
16	34.2671	5.1422
17	35.7184	5.6973
18	37.1564	6.2648
19	38.5821	6.8439
20	39.9969	7.4338
21	41.4009	8.0336

Figura 30: Probabilidad usando tablas

Usando Probability Distributions

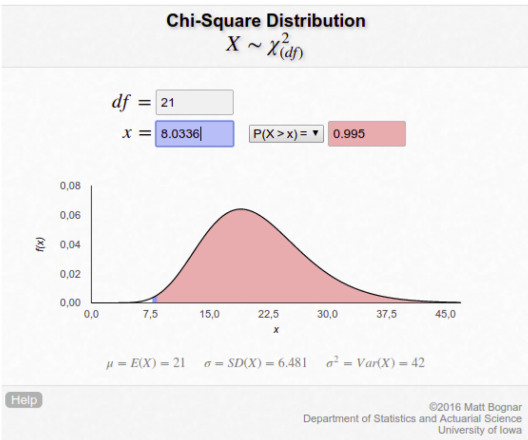


Figura 31: Probabilidad usando la aplicación

Usando R

```
> #11
> pchisq(8.0336,21, lower.tail = F)
[1] 0.9950002
```

Figura 32: Probabilidad usando R

1.4. Distribución T-student

1.4.1. $P(T_7 < k) = 0.9$

Procedimiento
$P(T_7 < k) = 0.9$
$\rightarrow P(T_7 > k) = 0.1$
$k = 1.4149$
Usando tablas

	Valores de la probabilidad α área derecha (pa							
gl=ν	0.065	0.070	0.075	0.080	0.085	0.090	0.095	0.10
1	4.8288	4.4737	4.1653	3.8947	3.6554	3.4420	3.2506	3.0777
2	2.4954	2.3834	2.2819	2.1894	2.1045	2.0261	1.9534	1.8856
3	2.0719	1.9950	1.9243	1.8589	1.7981	1.7413	1.6880	1.6377
4	1.9016	1.8375	1.7782	1.7229	1.6712	1.6226	1.5767	1.5332
5	1.8104	1.7529	1.6994	1.6493	1.6023	1.5579	1.5158	1.4759
6	1.7538	1.7002	1.6502	1.6033	1.5590	1.5172	1.4775	1.4398
7	1.7153	1.6643	1.6166	1.5718	1.5295	1.4894	1.4513	1.4149
8	1.6874	1.6383	1.5922	1.5489	1.5079	1.4691	1.4321	1.3968
9	1.6663	1.6185	1.5737	1.5315	1.4916	1.4537	1.4175	1.3830
10	1.6498	1.6031	1.5592	1.5179	1.4788	1.4416	1.4061	1.3722

Figura 33: Probabilidad usando tablas

Usando Probability Distributions

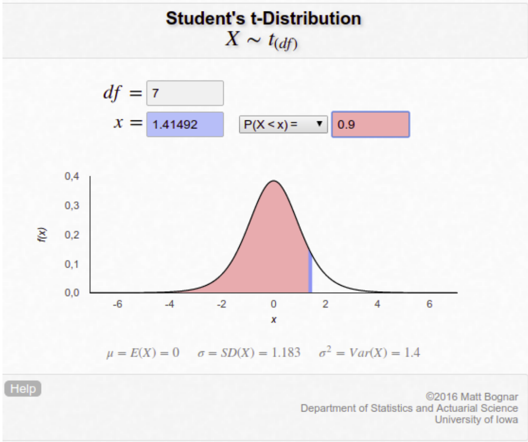


Figura 34: Probabilidad usando la aplicación

Usando R

1.4.2. $P(T_{14} > k) = 0.05$

$k = 1.76$

Usando tablas

	Valores de la probabilidad α área derecha de la distribución t-student (para los cuantiles se cam												
gl=n	**0.0080**	**0.0085**	**0.0090**	**0.0095**	**0.010**	**0.015**	**0.020**	**0.025**	**0.030**	**0.035**	**0.040**	**0.045**	**0.050**
1	39.780	37.439	35.359	33.496	31.821	21.205	15.894	12.706	10.579	9.058	7.916	7.026	6.314
2	7.810	7.572	7.353	7.151	6.965	5.643	4.849	4.303	3.896	3.578	3.320	3.104	2.920
3	4.930	4.821	4.721	4.628	4.541	3.896	3.482	3.182	2.951	2.763	2.605	2.471	2.353
4	4.010	3.937	3.870	3.806	3.747	3.298	2.999	2.776	2.601	2.456	2.333	2.226	2.132
5	3.573	3.516	3.462	3.412	3.365	3.003	2.757	2.571	2.422	2.297	2.191	2.098	2.015
6	3.320	3.272	3.226	3.183	3.143	2.829	2.612	2.447	2.313	2.201	2.104	2.019	1.943
7	3.157	3.113	3.073	3.034	2.998	2.715	2.517	2.365	2.241	2.136	2.046	1.966	1.895
8	3.043	3.003	2.965	2.930	2.896	2.634	2.449	2.306	2.189	2.090	2.004	1.928	1.860
9	2.958	2.921	2.886	2.853	2.821	2.574	2.398	2.262	2.150	2.055	1.973	1.899	1.833
10	2.894	2.859	2.825	2.794	2.764	2.527	2.359	2.228	2.120	2.028	1.948	1.877	1.812
11	2.843	2.809	2.777	2.747	2.718	2.491	2.328	2.201	2.096	2.007	1.928	1.859	1.796
12	2.801	2.769	2.738	2.709	2.681	2.461	2.303	2.179	2.076	1.989	1.912	1.844	1.782
13	2.767	2.736	2.706	2.677	2.650	2.436	2.282	2.160	2.060	1.974	1.899	1.832	1.771
14	2.739	2.708	2.678	2.651	2.624	2.415	2.264	2.145	2.046	1.962	1.887	1.821	1.761
15	2.714	2.684	2.655	2.628	2.602	2.397	2.249	2.131	2.034	1.951	1.878	1.812	1.753

Figura 35: Probabilidad usando tablas

Usando Probability Distributions

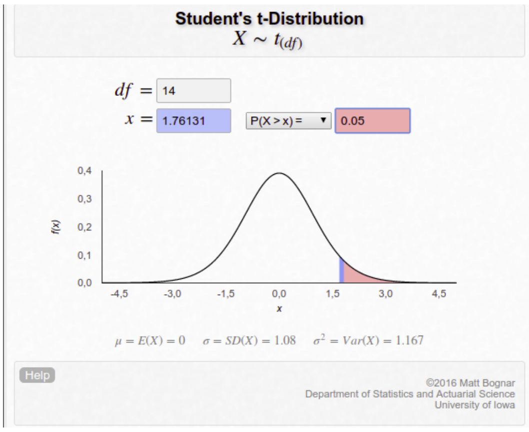


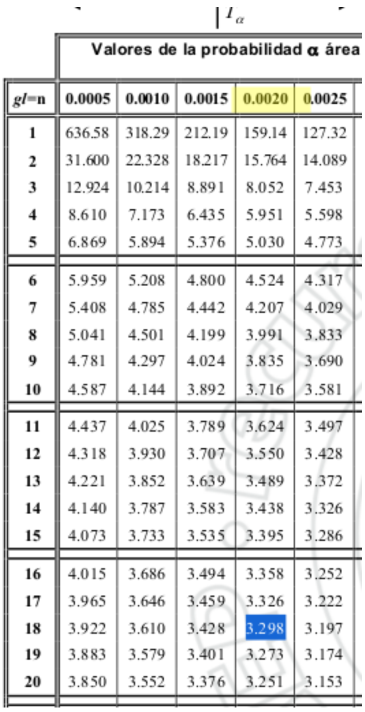
Figura 36: Probabilidad usando la aplicación

Usando R

1.4.3. $P(T_{18} > 3.298) =$

$P(T_{18} > 3.298) = 0.0020$

Usando tablas



t_α

	Valores de la probabilidad α área				
gl=n	0.0005	0.0010	0.0015	0.0020	0.0025
1	636.58	318.29	212.19	159.14	127.32
2	31.600	22.328	18.217	15.764	14.089
3	12.924	10.214	8.891	8.052	7.453
4	8.610	7.173	6.435	5.951	5.598
5	6.869	5.894	5.376	5.030	4.773
6	5.959	5.208	4.800	4.524	4.317
7	5.408	4.785	4.442	4.207	4.029
8	5.041	4.501	4.199	3.991	3.833
9	4.781	4.297	4.024	3.835	3.690
10	4.587	4.144	3.892	3.716	3.581
11	4.437	4.025	3.789	3.624	3.497
12	4.318	3.930	3.707	3.550	3.428
13	4.221	3.852	3.639	3.489	3.372
14	4.140	3.787	3.583	3.438	3.326
15	4.073	3.733	3.535	3.395	3.286
16	4.015	3.686	3.494	3.358	3.252
17	3.965	3.646	3.459	3.326	3.222
18	3.922	3.610	3.428	3.298	3.197
19	3.883	3.579	3.401	3.273	3.174
20	3.850	3.552	3.376	3.251	3.153

Figura 37: Probabilidad usando tablas

Usando Probability Distributions

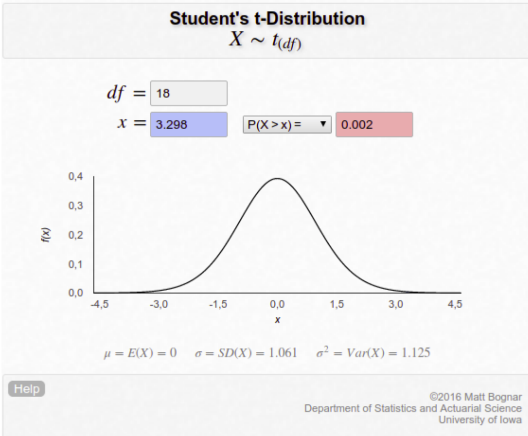


Figura 38: Probabilidad usando la aplicación

1.4.4. $P(T_6 < -4.317) =$

Procedimiento

$P(T_6 < -4.317) = P(T_6 > 4.317)$

$P(T_6 > 4.317) = 0.0025$

Usando tablas

α

	Valores de la probabilidad α área				
***gl*=n**	**0.0005**	**0.0010**	**0.0015**	**0.0020**	**0.0025**
1	636.58	318.29	212.19	159.14	127.32
2	31.600	22.328	18.217	15.764	14.089
3	12.924	10.214	8.891	8.052	7.453
4	8.610	7.173	6.435	5.951	5.598
5	6.869	5.894	5.376	5.030	4.773
6	5.959	5.208	4.800	4.524	4.317
7	5.408	4.785	4.442	4.207	4.029
8	5.041	4.501	4.199	3.991	3.833
9	4.781	4.297	4.024	3.835	3.690
10	4.587	4.144	3.892	3.716	3.581

Figura 39: Probabilidad usando tablas

Usando Probability Distributions

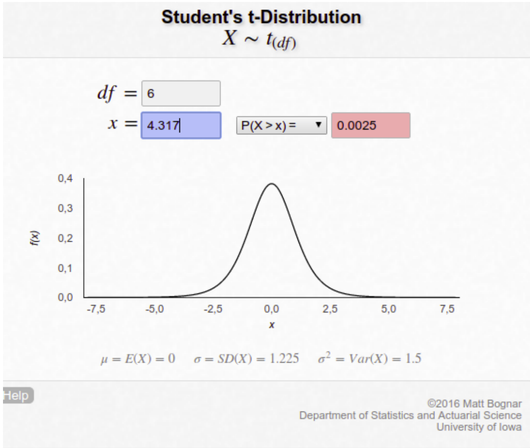


Figura 40: Probabilidad usando la aplicación

1.4.5. $P(T_6 < 4.317) =$

Procedimiento

$P(T_6 < 4.317) = 1 - P(T_6 > 4.317)$

$\rightarrow P(T_6 > 4.317) = 0.0025$

$\therefore P(T_6 < 4.317) = 1 - 0.0025 = 0.9975$

Usando tablas

Hay que tener cuidado ya que en las tablas encontraremos el complemento.

ν_1 grados de libertad del numerador y ν_2 grados de libertad del denominador; ν_1 y $\alpha = 0.025$																			
ν_2	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	648	799	864	900	922	937	948	957	963	969	973	977	980	983	985	987	989	990	992
2	38.5	39.0	39.2	39.2	39.3	39.3	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4
3	17.44	16.04	15.44	15.10	14.88	14.73	14.62	14.54	14.47	14.42	14.37	14.34	14.30	14.28	14.25	14.23	14.21	14.20	14.18
4	12.22	10.65	9.98	9.60	9.36	9.20	9.07	8.98	8.90	8.84	8.79	8.75	8.71	8.68	8.66	8.63	8.61	8.59	8.58
5	10.01	8.43	7.76	7.39	7.15	6.98	6.85	6.76	6.68	6.62	6.57	6.52	6.49	6.46	6.43	6.40	6.38	6.36	6.34
6	8.81	7.26	6.60	6.23	5.99	5.82	5.70	5.60	5.52	5.46	5.41	5.37	5.33	5.30	5.27	5.24	5.22	5.20	5.18
7	8.07	6.54	5.89	5.52	5.29	5.12	4.99	4.90	4.82	4.76	4.71	4.67	4.63	4.60	4.57	4.54	4.52	4.50	4.48
8	7.57	6.06	5.42	5.05	4.82	4.65	4.53	4.43	4.36	4.30	4.24	4.20	4.16	4.13	4.10	4.08	4.05	4.03	4.02
9	7.21	5.71	5.08	4.72	4.48	4.32	4.20	4.10	4.03	3.96	3.91	3.87	3.83	3.80	3.77	3.74	3.72	3.70	3.68
10	6.94	5.46	4.83	4.47	4.24	4.07	3.95	3.85	3.78	3.72	3.66	3.62	3.58	3.55	3.52	3.50	3.47	3.45	3.44

Figura 41: Probabilidad usando tablas

Usando Probability Distributions

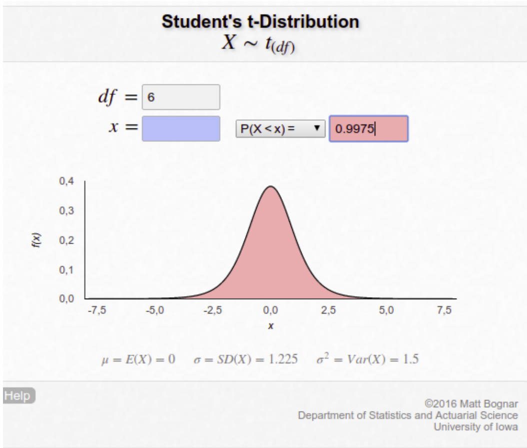


Figura 42: Probabilidad usando la aplicación

1.5. Distribución F

1.5.1. $P(X(10, 15) < k) = 0.025 = \alpha$

$k = 3.52$
Usando tablas

ν_1 grados de libertad del numerador y ν_2 grados de libertad del denominador; ν_1 y $\alpha = 0.005$																			
ν_2	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**
1	16211	19999	21615	22500	23056	23437	23715	23925	24091	24224	24334	24426	24505	24572	24630	24681	24727	24767	24803
2	198.5	199.0	199.2	199.2	199.3	199.3	199.4	199.4	199.4	199.4	199.4	199.4	199.4	199.4	199.4	199.4	199.4	199.4	199.4
3	55.55	49.80	47.47	46.19	45.39	44.84	44.43	44.13	43.88	43.69	43.52	43.39	43.27	43.17	43.08	43.01	42.94	42.88	42.83
4	31.33	26.28	24.26	23.16	22.46	21.98	21.62	21.35	21.14	20.97	20.82	20.71	20.60	20.52	20.44	20.37	20.31	20.26	20.21
5	22.79	18.31	16.53	15.56	14.94	14.51	14.20	13.96	13.77	13.62	13.49	13.38	13.29	13.22	13.15	13.09	13.03	12.99	12.94
6	18.64	14.54	12.92	12.03	11.46	11.07	10.79	10.57	10.39	10.25	10.13	10.03	9.950	9.877	9.814	9.758	9.709	9.664	9.625
7	16.24	12.40	10.88	10.05	9.522	9.155	8.885	8.678	8.514	8.380	8.270	8.176	8.097	8.028	7.968	7.915	7.868	7.826	7.788
8	14.69	11.04	9.596	8.805	8.302	7.952	7.694	7.496	7.339	7.211	7.104	7.015	6.938	6.872	6.814	6.763	6.718	6.678	6.641
9	13.61	10.11	8.717	7.956	7.471	7.134	6.885	6.693	6.541	6.417	6.314	6.227	6.153	6.089	6.032	5.983	5.939	5.899	5.864
10	12.83	9.427	8.081	7.343	6.872	6.545	6.302	6.116	5.968	5.847	5.746	5.661	5.589	5.526	5.471	5.422	5.379	5.340	5.305
11	12.23	8.912	7.600	6.881	6.422	6.102	5.865	5.682	5.537	5.418	5.320	5.236	5.165	5.103	5.049	5.001	4.959	4.921	4.886
12	11.75	8.510	7.226	6.521	6.071	5.757	5.525	5.345	5.202	5.085	4.988	4.906	4.836	4.775	4.721	4.674	4.632	4.595	4.561
13	11.37	8.186	6.926	6.233	5.791	5.482	5.253	5.076	4.935	4.820	4.724	4.643	4.573	4.513	4.460	4.413	4.372	4.334	4.301
14	11.06	7.922	6.680	5.998	5.562	5.257	5.031	4.857	4.717	4.603	4.508	4.428	4.359	4.299	4.247	4.200	4.159	4.122	4.089
15	10.80	7.701	6.476	5.803	5.372	5.071	4.847	4.674	4.536	4.424	4.329	4.250	4.181	4.122	4.070	4.024	3.983	3.946	3.913

Figura 43: Probabilidad usando tablas

1.5.2. $P(X(10, 15) < 4.424) =$

$P(X(10, 15) < 4.424) = 1 - 1/P(X(15, 10) < 4.424) = 1 - 0.005 = 0.995$
Usando tablas

ν_1 grados de libertad del numerador y ν_2 grados de libertad del denominador; ν_1 y $\alpha = 0.005$

ν_2	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	16211	19999	21615	22500	23056	23437	23715	23925	24091	24224	24334	24426	24505	24572	24630	24681	24727	24767	24803
2	198.5	199.0	199.2	199.2	199.3	199.3	199.4	199.4	199.4	199.4	199.4	199.4	199.4	199.4	199.4	199.4	199.4	199.4	199.4
3	55.55	49.80	47.47	46.19	45.39	44.84	44.43	44.13	43.88	43.69	43.52	43.39	43.27	43.17	43.08	43.01	42.94	42.88	42.83
4	31.33	26.28	24.26	23.16	22.46	21.98	21.62	21.35	21.14	20.97	20.82	20.71	20.60	20.52	20.44	20.37	20.31	20.26	20.21
5	22.79	18.31	16.53	15.56	14.94	14.51	14.20	13.96	13.77	13.62	13.49	13.38	13.29	13.22	13.15	13.09	13.03	12.99	12.94
6	18.64	14.54	12.92	12.03	11.46	11.07	10.79	10.57	10.39	10.25	10.13	10.03	9.950	9.877	9.814	9.758	9.709	9.664	9.625
7	16.24	12.40	10.88	10.05	9.522	9.155	8.885	8.678	8.514	8.380	8.270	8.176	8.097	8.028	7.968	7.915	7.868	7.826	7.788
8	14.69	11.04	9.596	8.805	8.302	7.952	7.694	7.496	7.339	7.211	7.104	7.015	6.938	6.872	6.814	6.763	6.718	6.678	6.641
9	13.61	10.11	8.717	7.956	7.471	7.134	6.885	6.693	6.541	6.417	6.314	6.227	6.153	6.089	6.032	5.983	5.939	5.899	5.864
10	12.83	9.427	8.081	7.343	6.872	6.545	6.302	6.116	5.968	5.847	5.746	5.661	5.589	5.526	5.471	5.422	5.379	5.340	5.305
11	12.23	8.912	7.600	6.881	6.422	6.102	5.865	5.682	5.537	5.418	5.320	5.236	5.165	5.103	5.049	5.001	4.959	4.921	4.886
12	11.75	8.510	7.226	6.521	6.071	5.757	5.525	5.345	5.202	5.085	4.988	4.906	4.836	4.775	4.721	4.674	4.632	4.595	4.561
13	11.37	8.186	6.926	6.233	5.791	5.482	5.253	5.076	4.935	4.820	4.724	4.643	4.573	4.513	4.460	4.413	4.372	4.334	4.301
14	11.06	7.922	6.680	5.998	5.562	5.257	5.031	4.857	4.717	4.603	4.508	4.428	4.359	4.299	4.247	4.200	4.159	4.122	4.089
15	10.80	7.701	6.476	5.803	5.372	5.071	4.847	4.674	4.536	4.424	4.329	4.250	4.181	4.122	4.070	4.024	3.983	3.946	3.913

Figura 44: Probabilidad usando tablas

Usando Probability Distributions

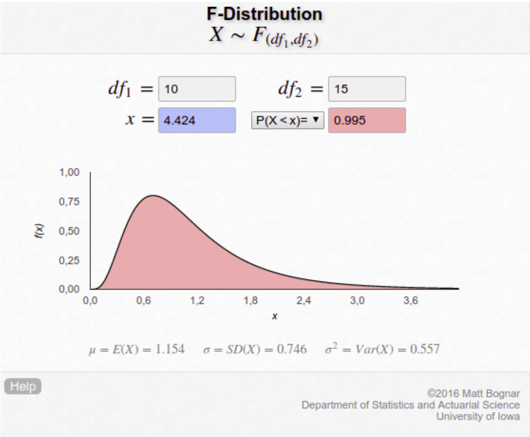


Figura 45: Probabilidad usando la aplicación

1.5.3. $P(X(19,6) > k) = 0.01 = \alpha$

$P(X(19,6) > k) = 0.01 = 1 - P(X(6,19) < k)$
$k = 7.42$

Usando tablas

ν_2	ν_1 grados de libertad del numerador y ν_2 grados de libertad del denominador; ν_1 y $\alpha = 0.01$																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	4052	4999	5403	5625	5764	5859	5928	5981	6022	6056	6083	6106	6126	6143	6157	6170	6181	6192	6201
2	98.5	99.0	99.2	99.2	99.3	99.3	99.4	99.4	99.4	99.4	99.4	99.4	99.4	99.4	99.4	99.4	99.4	99.4	99.4
3	34.12	30.82	29.46	28.71	28.24	27.91	27.67	27.49	27.35	27.23	27.13	27.05	26.98	26.92	26.87	26.83	26.79	26.75	26.72
4	21.20	18.00	16.69	15.98	15.52	15.21	14.98	14.80	14.66	14.55	14.45	14.37	14.31	14.25	14.20	14.15	14.11	14.08	14.05
5	16.26	13.27	12.06	11.39	10.97	10.67	10.46	10.29	10.16	10.05	9.96	9.89	9.82	9.77	9.72	9.68	9.64	9.61	9.58
6	13.75	10.92	9.78	9.15	8.75	8.47	8.26	8.10	7.98	7.87	7.79	7.72	7.66	7.60	7.56	7.52	7.48	7.45	7.42
7	12.25	9.55	8.45	7.85	7.46	7.19	6.99	6.84	6.72	6.62	6.54	6.47	6.41	6.36	6.31	6.28	6.24	6.21	6.18
8	11.26	8.65	7.59	7.01	6.63	6.37	6.18	6.03	5.91	5.81	5.73	5.67	5.61	5.56	5.52	5.48	5.44	5.41	5.38
9	10.56	8.02	6.99	6.42	6.06	5.80	5.61	5.47	5.35	5.26	5.18	5.11	5.05	5.01	4.96	4.92	4.89	4.86	4.83
10	10.04	7.56	6.55	5.99	5.64	5.39	5.20	5.06	4.94	4.85	4.77	4.71	4.65	4.60	4.56	4.52	4.49	4.46	4.43
11	9.65	7.21	6.22	5.67	5.32	5.07	4.89	4.744	4.632	4.539	4.462	4.397	4.342	4.293	4.251	4.213	4.180	4.150	4.123
12	9.33	6.93	5.95	5.41	5.06	4.821	4.640	4.499	4.388	4.296	4.220	4.155	4.100	4.052	4.010	3.972	3.939	3.909	3.883
13	9.07	6.70	5.74	5.21	4.862	4.620	4.441	4.302	4.191	4.100	4.025	3.960	3.905	3.857	3.815	3.778	3.745	3.716	3.689
14	8.86	6.51	5.56	5.035	4.695	4.456	4.278	4.140	4.030	3.939	3.864	3.800	3.745	3.698	3.656	3.619	3.586	3.556	3.529
15	8.68	6.36	5.42	4.893	4.556	4.318	4.142	4.004	3.895	3.805	3.730	3.666	3.612	3.564	3.522	3.485	3.452	3.423	3.396
16	8.53	6.23	5.29	4.773	4.437	4.202	4.026	3.890	3.780	3.691	3.616	3.553	3.498	3.451	3.409	3.372	3.339	3.310	3.283
17	8.40	6.11	5.185	4.669	4.336	4.102	3.927	3.791	3.682	3.593	3.519	3.455	3.401	3.353	3.312	3.275	3.242	3.212	3.186
18	8.29	6.01	5.092	4.579	4.248	4.015	3.841	3.705	3.597	3.508	3.434	3.371	3.316	3.269	3.227	3.190	3.158	3.128	3.101
19	8.18	5.93	5.010	4.500	4.171	3.939	3.765	3.631	3.523	3.434	3.360	3.297	3.242	3.195	3.153	3.116	3.084	3.054	3.027
20	8.10	5.85	4.938	4.431	4.103	3.871	3.699	3.564	3.457	3.368	3.294	3.231	3.177	3.130	3.088	3.051	3.018	2.989	2.962

Figura 46: Probabilidad usando tablas

Usando Probability Distributions

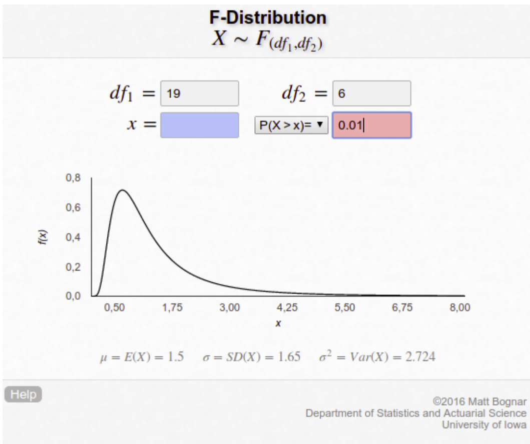


Figura 47: Probabilidad usando la aplicación

1.5.4. $P(X(12, 10) < 4.471) =$

El valor más aproximado a 4.471 es 4.296
$P(X(12, 10) < 4.471) = 0.01$
Usando tablas

	ν_1 grados de libertad del numerador y ν_2 grados d									
ν_2	1	2	3	4	5	6	7	8	9	10
1	4052	4999	5403	5625	5764	5859	5928	5981	6022	6056
2	98.5	99.0	99.2	99.2	99.3	99.3	99.4	99.4	99.4	99.4
3	34.12	30.82	29.46	28.71	28.24	27.91	27.67	27.49	27.35	27.23
4	21.20	18.00	16.69	15.98	15.52	15.21	14.98	14.80	14.66	14.55
5	16.26	13.27	12.06	11.39	10.97	10.67	10.46	10.29	10.16	10.05
6	13.75	10.92	9.78	9.15	8.75	8.47	8.26	8.10	7.98	7.87
7	12.25	9.55	8.45	7.85	7.46	7.19	6.99	6.84	6.72	6.62
8	11.26	8.65	7.59	7.01	6.63	6.37	6.18	6.03	5.91	5.81
9	10.56	8.02	6.99	6.42	6.06	5.80	5.61	5.47	5.35	5.26
10	10.04	7.56	6.55	5.99	5.64	5.39	5.20	5.06	4.94	4.85
11	9.65	7.21	6.22	5.67	5.32	5.07	4.89	4.744	4.632	4.539
12	9.33	6.93	5.95	5.41	5.06	4.821	4.640	4.499	4.388	4.296
13	9.07	6.70	5.74	5.21	4.862	4.620	4.441	4.302	4.191	4.100

Figura 48: Probabilidad usando tablas

Usando Probability Distributions

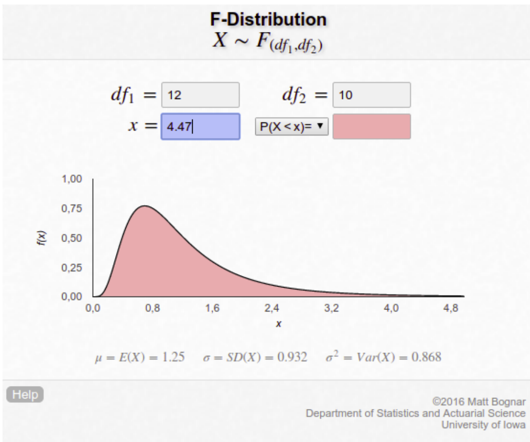


Figura 49: Probabilidad usando la aplicación

2. Conclusiones

El cálculo de probabilidades requiere de un gran dominio de los conceptos ya que de otra manera obtenedremos la probabilidad equivocada. Ahora bien, también es importante que sepamos manejar la herramienta que estemos usando para manejar probabilidades, por ejemplo, las tablas, una aplicación o un lenguaje de programación como R.

3. Bibliografía

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